NATIONAL WEATHER SERVICE
OFFICE of HYDROLOGIC DEVELOPMENT

HEFS 1.0.1 TEST PLAN

Version 1.4
08/21/2013

Revision History

Date	Version	Description	Author
06/25/2013	1.0	Initial Draft	Shaif Hussain
7/19/2013	1.1	Review Draft	Shaif Hussain
8/9/2013	1.2	Review Draft	Mark Fresch
8/16/2013	1.3	Review Draft	Shaif Hussain
8/21/2013	1.4	Updated Appendix A	Shaif Hussain
11/27/13	1.5	No change for 1.0.2	Shaif Hussain

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1. Introduction and Scope

This document is intended for National Weather Service (NWS) testers, River Forecast Center (RFC) forecasters, and other project stakeholders. The purpose of the Test Plan is to provide a plan of action, the scope, approach, resources, and schedule of intended activities that the Office of Hydrologic Development's Hydrologic Software Engineering Branch (OHD-HSEB) will undertake for testing the requirements that meet the specific criteria for the Hydrological Ensemble Forecast Service (HEFS) project.

The tests described in this document will used for testing the next HEFS release, HEFS 1.0.1 and a subsequent HEFS maintenance release which will include CHPS 4.0.1 This plan will cover all testing phases for release, including integration, regression, beta and operational test.

Regression – A suite of tests covering software functionality available in previous versions of HEFS. The suite of tests produces results which are compared to benchmarks. The benchmarks are results from the same procedures, but using an earlier version of the software. The tests are run to compare the results from the latest version of HEFS to ensure, where expected, the software performs the same. The test includes numerical value, GUI behavior, and performance comparisons.

Integration – The latest version of HEFS will be tested in a controlled test environment at OHD using the latest version of hardware and software. The test environment will emulate the anticipated environment at the RFC's. Tests include canned (SA) and live HEFS runs.

Beta – The latest version of HEFS will be set-up and tested at all HEFS test RFC's by forecasters. This involves testing of FobBugz issues which include fixes and enhancements and existing HEFS workflows using SA and the "live" system.

Operational – A test to ensure all the specifications of the NYCDEP are met. This test will be tested at MARFC and NERFC by forecasters.

1.1 Identification

Project ID :	**HEFS Test Plan**		
Project Lead		**Project Area Lead**	**Mark Fresch**
System	*HEFS*	**Target Release**	*1.0.1*

1.2 References

1. HEFS Test Manual 1.0.1
2. HEFS Install Notes 1.01
3. EnsPost Configuration Guide 1.0.1
4. EnsPostPE Configuration Guide 1.0.1
5. HEFS Graphics Generator Product Installation Guide 1.0.1
6. HEFS Hindcasting Guide 1.0.1
7. MEFP Configuration Guide: Data Ingest 1.0.1
8. MEFP Configuration Guide: Forecast 1.0.1
9. MEFPPE Configuration Guide 1.0.1
10. HEFS Overview and Getting Started 1.0.1
11. MEFP Users Manual 1.0.1
12. HEFS Standalone Setup and Regression Test Procedure on NHDR

1.3 Test objectives

The main objective of all tests is to ensure that the software is working properly. In addition, an objective of the Operational Test is that the HEFS forecasts are done according to the specifications of the NYCDEP.

Additional testing will be done following the Test Manual for bug fixes and enhancements. A list of items is provided below at Appendix A – FogBugz. At OHD the configuration and testing will be done by OHD and HSD personnel, and, at RFCs, testing will be done by the forecasters.

It is not an objective of to test the skill and the science of the HEFS project. The skill of HEFS forecasts are being evaluated though an ongoing science validation process and the findings will be documented separately.

For testing purposes, OHD will obtain the result from daily HEFS runs for one month thereafter.

1.4 Constraints and Limitations

The CHPS-4.0.1 schedule and the RFCs setup of HEFS 1.0.1 are constraints. The beta test will occur after the RFCs have setup HEFS 1.0.1. The operational test will occur after

MARFC and NERFC has installed CHPS 4.0.1 and the HEFS maintenance release on their HEFS systems.

CHPS 4.0.1 is planned for release in late October. The HEFS maintenance release is planned for 2 weeks following the CHPS 4.0.1 release. If the CHPS 4.0.1 release slips, then the operational test will use HEFS 1.0.1.

1.5 Test Acceptance Criteria

Regression tests results should match the benchmark results. Any differences will be communicated to the development team by the configuration manager. The test will be re-run after it has been fixed. If it is determined the result is better than the benchmark the benchmark result will be updated with the new one.

For the integration test to pass the expected results shown in the test procedures (e.g., expected text output or expected graphical displays) should appear as shown in the test procedures. In most cases, If the actual result does not match the expected result, it will be communicated with the development team to determine if it's a software or documentation issue. For software issues the test will be re-run after it has been fixed. For documentation issues the expected result section will be updated for the document.

RFCs need to test and confirm the fix for their FogBugz cases that have been fixed in the release as part of the Beta testing. For Beta testing RFCs will also need go through the test manual and provide feedback through the feedback forms.

2. Methodology

2.1 Test Strategy

The test environments setup for the workshop and testing and the testing of the previous release will be reused. Changes will be made to update it to the latest release. The Confirm Configuration section will be followed in each of the guides to confirm the environment has been setup correctly as part of the integration testing.

Integration testing will be done on the NHDR development machines and the NHDR Live system. On the NHDR development machines, testing will be done for all five test RFCs (ABRFC, CBRFC, CNRFC, MARFC & NERFC). NHDR Live system testing will be done for NERFC. The test manual will be followed to ensure all the functionalities are tested during the integration testing.

Regression testing will be done on the NHDR development machines for CBRFC and MARFC. Extra export modules will be added to the workflow for regression testing. Test

procedures in the document referenced above will be used for regression testing. The test results will compared with benchmark files that have been created using HEFS 0.3.2.

Beta testing will be done at the RFC on their system. Testing will be done following the test manual and feedback will be gathered using the feedback form at the end of the document. In addition to following the test manual FogBugz reported by each RFCs have to be tested by them. Appendix A – FogBugz is a list of all the FogBugz addressed in this release. It also indicates the issues that will be tested during integration testing.

Operational testing will be performed on the operational HEFS system configured by the RFC with CHPS 4.0.1. For 30 days after the operational systems have been setup OHD/HSEB will monitor the operational runs. Operational test will be done for all New York City (NYC) locations for MARFC (14 locations) and NERFC (8 locations). A list of all the locations and data requirements can be found in Appendix B – Operational test locations. The test will verify forecasts are being consistently generated for all locations by analyzing the products expected to be delivered to NYC (i.e. HEFS streamflow forecasts xml files) for completeness.

2.2 Test Environment

Integration and regression testing will be done using Delft-FEWS version 2012.02, build number 39282 (patched from 38987) and Java version 6 on the NHDR machines. Live testing will be done on the NHDR and the NHOR Live system. Beta testing and operational testing will be done at the RFC on their individual environments.

2.3 Requirements

1. OHD will use the NHDR development and test machines for internal testing.
2. HSD will use the NHDR and the NHORLive system for live end-to-end testing.

2.4 Test Input Conditions and Data Requirements

Integration test:

- HEFS will be configured and tested for two locations for all five test RFCs.
- Configuration will build upon the setup used for the HEFS 0.3.2 workshop.
- Data required for all the tests will also be used from the HEFS 0.3.2 workshop.

Regression test:

- HEFS 0.3.2 workshop configurations have been used to generate the benchmark results.

- For HEFS 1.0.1, the configuration will build upon the existing regression test setup.

Operational test:

- GEFS: 0 - 15 days
- CFSv2: 15 - 270 days
- Climatology: 270 - 365 days
- MARFC and NERFC
  - For all NYC locations, MEFP operational runs use the same control parameters used at OHD for MEFP hindcast runs (GEFS, CFSV2, climatology - no RFC data source)
  - No linkage between NYC HEFS runs and operational CHPS runs (no synchronizing)
  - Flow forecasts are from warm states (30 days back), no mods
  - No EnsPost in flow forecasts sent to RTI
  - No ADJUST-Q in flow forecasts sent to RTI
  - Export operational flow forecasts to xml files (see previous emails for specifics) and send to RTI using existing mechanisms
  - For operational MEFP runs, set GEFS forecast period to 15 days, CFSv2 to 270 days, and climatology to 365 days (with "observed climatology" option turned on for precipitation and resampled climatology option turned on for temperature).
- MARFC only
  - All NYC locations produce 48 traces (1950-1997)
- NERFC only
  - WBCN6 and NCRN6 (two head water basins) produce 36 traces (1961-1996) **
  - Six other NYC locations produce 47 traces (1950-1996) **

** This is accomplished by using two separate workflows (e.g MEFP and Streamflow)

2.5 Test Output/Test Results

Integration test:

- Test output/results should match as documented in the test manual.
- Graphical displays of the MEFP results, EnsPost input and output.

Regression test:

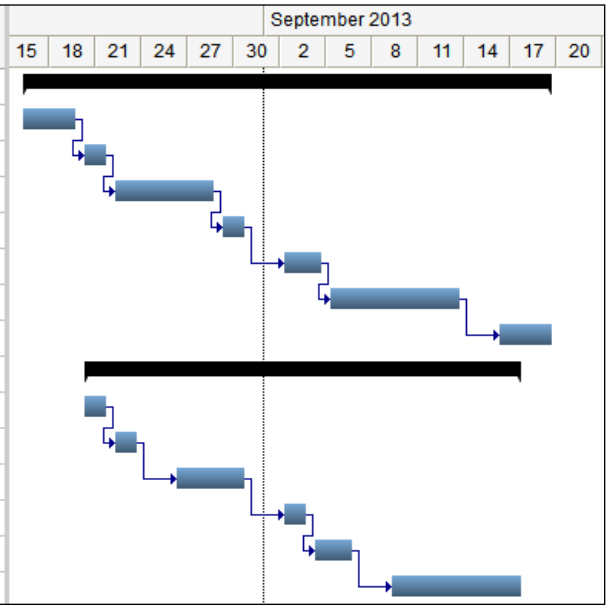
- Total of 18 export files should be generated. The files are the export results of different modules in the MEFP stream flow forecast and EnsPost workflows.

Operational test:

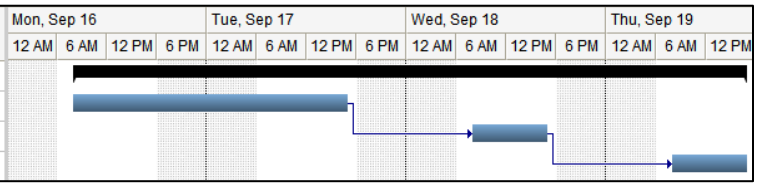
- Forecast results for all NYC locations (14 MARFC & 8 NERFC).

3. Test Schedule and Milestones

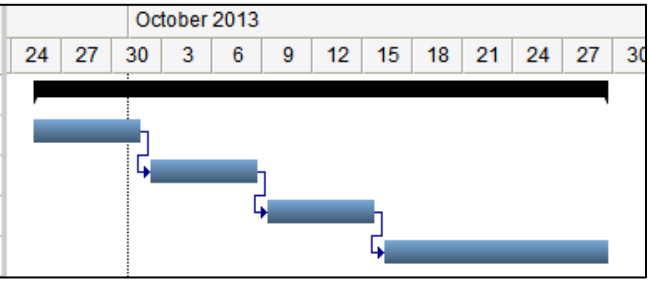
	Name	Duration	Start	Finish
1	**HEFS v1 Integration Testing**	25d	**08/16/2013**	**09/19/2013**
2	MEFP PE	2d	08/16/2013	08/19/2013
3	EnsPost PE	2d	08/20/2013	08/21/2013
4	MEFP Forecast	5d	08/22/2013	08/28/2013
5	MEFP Streamflow	2d	08/29/2013	08/30/2013
6	EnsPost	3d	09/02/2013	09/04/2013
7	Graphics Generator	7d	09/05/2013	09/13/2013
8	Additional Testing	4d	09/16/2013	09/19/2013
9	**Live System (NHDR LIVE)**	21d	**08/20/2013**	**09/17/2013**
10	MEFP PE	2d	08/20/2013	08/21/2013
11	EnsPost PE	2d	08/22/2013	08/23/2013
12	MEFP Forecast	5d	08/26/2013	08/30/2013
13	MEFP Streamflow	2d	09/02/2013	09/03/2013
14	EnsPost	3d	09/04/2013	09/06/2013
15	Graphics Generator	7d	09/09/2013	09/17/2013



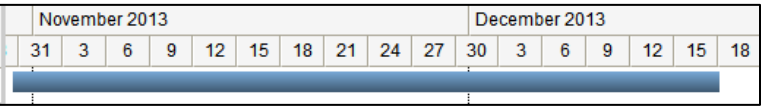
	Name	Duration	Start	Finish
1	**Regression Testing**	4d	**09/16/2013**	**09/19/2013**
2	GUI Testing	2d	09/16/2013	09/17/2013
3	Value comparison Testing	1d	09/18/2013	09/18/2013
4	Performance Testing	1d	09/19/2013	09/19/2013



	Name	Duration	Start	Finish
1	**Beta Testing**	25d	**09/25/2013**	**10/29/2013**
2	MEFP Forecast	5d	09/25/2013	10/01/2013
3	MEFP Streamflow	5d	10/02/2013	10/08/2013
4	EnsPost	5d	10/09/2013	10/15/2013
5	Graphics Generator	10d	10/16/2013	10/29/2013



	Name	Duration	Start	Finish
1	Operational Testing	35d	10/30/2013	12/17/2013



4. Risks and Mitigation Strategy

	Risks	Mitigation Strategy
1	Delay in the release of CHPS 4.0.1 will delay the setting up of an operational HEFS. Operational testing will began only after HEFS 1.0.1 has been configured with CHPS 4.0.1.	The latest HEFS will be tested using the "current" release of CHPS (CHPS-3.1.1) and, if needed, re-release HEFS when CHPS 4.0.1 is ready.

5. APPENDICES

Appendix A – FogBugz

Case	Title	OHD	RFC
1086	Displaying GEFS grids for CONUS	NO	CBRFC
1091	GDS Exception Error	NO	CNRFC
1093	MEFPPE Explorer Plugin Error	NO	CNRFC
1094	Model Import Time Period	YES	CNRFC
1106	MEFPPE Parameter Estimating Error	YES	CNRFC
1113	MEFPPE cannot read TAMN/TAMX files	NO	ABRFC
1118	Updates to non software related files delivered with HEFS-0.3.2	NO	NERFC
1119	jar file missing from tarball (affects EnsPostPE and MEFPPE)	NO	CBRFC
1124	Unable to calculate parameters	YES	CNRFC
1133	MEFP RFC QPF seems unrealistic	YES	ABRFC
1146	Slowness caused by adding MEFP to MergeMap	NO	ABRFC
1150	MEFP performance issues at CNRFC	YES	CNRFC
1157	TMAX)"> Modify MEFPPE to allow easier detecting of "bad" historical observed data (e.g. missing values, negative precip, TMIN > TMAX)	YES	ALL
1158	Modify MEFPPE to identify questionable MEFP parameter values (insufficient data, negative correlations)	YES	ALL
1159	Modify ENSPOST to add an option to output daily, instead of disaggregated, post-processed flows	YES	ALL
1166	Bias in TMIN/TMAX data from 1-deg GEFS reforecasts	YES	MARFC
1186	MEFPPE Default Estimation parameters	YES	CBRFC
1191	List of EnsPost PE enhancements for HEFS 1.0.1	YES	ALL
1195	MEFP Temperature Issue	YES	CNRFC
1200	Adding run file property to MEFP adapter for specifying member indexing year	YES	MARFC/NERFC
1202	Cleanup CFSv2 LaggedEnsemble.xml module files to remove WARNINGS messages	YES	ALL
1205	Using FEWS transformations to MERGE historical data with MEFP output	YES	MARFC/NERFC
1209	Error applying EnsPost parameters	YES	MARFC

Appendix B – Operational test locations

For operational MEFP runs, the GEFS forecast period will be set to 15 days, CFSv2 to 270 days, and climatology to 365 days (with the "observed climatology" option turned on for precipitation and the resampled climatology option turned on for temperature). Flow forecasts are from warm states (30 days back), and use no mods. The operator will use all available data for GEFS and CFSv2 calibration.

8 NE locations, 11 Time Series (TS) to export (3 TS for location ASEN6):

Location	Time Series	Parameter ID	Location ID
RONN6	TS1	SQIN	RONN6HUD
WBCN6	TS2	SQIN	WBCN6HUD
NCRN6	TS3	SQIN	NCRN6HUD
MTRN6	TS4	SQIN	MTRN6L
ASEN6	TS5, TS5a, TS5b	SQIN	ASEN6L, ASEN6WPL, ASEN6EPL
MRNN6	TS6	SQIN	MRNN6L
PTVN6	TS7	SQIN	PTVN6HUD
GILN6	TS8, TS9	SQIN	GILN6L, GILN6HUD

14 MA locations, 17 Time Series (TS) to export (2 TS for location CNNN6, 2 for FSHN6, and 2 for MTGN4):

Location	Time Series	Parameter ID	Location ID
WALN6	TS1	SQIN	WALN6TOT
CNNN6	TS2, TS3	SQIN	CNNN6NIF, CNN6TIF
DWNN6	TS4	SQIN	DWNN6TIF
HVDN6	TS5	SQIN	HVDN6TOT
CKFN6	TS6	SQIN	CKFN6TOT
FSHN6	TS7, TS8	SQIN	FSHN6TOT, FSHN6TOT
HLEN6	TS9	SQIN	HLEN6TOT
CCRN6	TS10	SQIN	CCRN6TOT
BRYN6	TS11	SQIN	BRYN6TOT
HWYP1	TS12	SQIN	HWYP1TOT
MTMP1	TS13	SQIN	MTMP1TOT

NVXN6	TS14	SQIN	NVXN6TIF
BRGN6	TS15	SQIN	BRGN6TOT
MTGN4	TS16, TS17	SQIN	MTGN4TOT, MTGN4TOT

Appendix C – Glossary

1. **HEFS -** Hydrologic Ensemble Forecast Service.
2. **NWS –** National Weather Service.
3. **RFC –** River Forecast Center.
4. **OHD –** Office of Hydrological Development
5. **HSEB -** Hydrological Ensemble Forecast Service
6. **MEFP -** Meteorological Ensemble Forecast Processor. A (Java based) rewrite of EPP3 (Fortran).
7. **EnsPost -** Ensemble Post-Processor.
8. **PE –** Parameter Estimation.
9. **ABRFC –** Arkansas-Red Basin RFC
10. **CBRFC –** Colorado Basin RFC
11. **CNRFC –** California-Navada RFC
12. **MARFC –** Middle Atlantic RFC
13. **NERFC –** Northeast RFC
14. **NHDR -** NWS Headquarters Development RFC Configuration
15. **NYC –** New York City
16. **GEFS -** Global Ensemble Forecast system
17. **CFSv2 -** Climate Forecast System.
18. **Climatology -** The science that deals with the phenomena of climates or climatic conditions. Climatology also refers the historical record of observations (e.g. mean areal averages of actual temperature and precipitation) used to drive a model.
19. **CHPS -** Community Hydrologic Prediction System.